

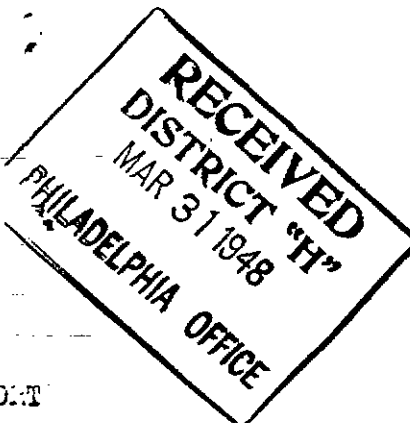
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REGISTERED PROFESSIONAL
CHEMICAL ENGINEERS



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CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS
GENERAL OFFICES AND LABORATORIES - GILLINGHAM AND WORTH STREETS
PHILADELPHIA 24, PENNSYLVANIA



REVISED ENGINEERING REPORT
INDUSTRIAL WASTE TREATMENT

PENN RIVET AND MACHINE COMPANY
PROPOSED NEW PLANT
HATBORO, PENNSYLVANIA

Betz Project No. 4754-W

February 20, 1948

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INTRODUCTION

Under date of March 10, 1947 we submitted to you our preliminary report covering our study and investigation of industrial wastes emanating from your Philadelphia Plant and which were being discharged to the Philadelphia city sewers. The purpose of this study was to accumulate data on your industrial wastes, both from the volume and from chemical characteristics, to determine a suitable method of treatment for discharge. At that time you were contemplating the erection of a new mill in the vicinity, however, the exact location had not been chosen. Since that time, you have purchased suitable property in Hatboro, Pennsylvania upon which the new mill is to be erected. As a part of the new construction suitable industrial waste treatment facilities are to be installed.

At the proposed location, you have available a municipal sanitary sewerage system that is available to receive the sanitary wastes from the proposed mill. We have obtained from the Hatboro municipal officials a letter indicating permission for you to discharge the sanitary wastes only to the sanitary sewerage system. A copy of this letter is made a part of the general report.

The preliminary report submitted to you was discussed with the Pennsylvania Department of Health district engineer and tentative approval for the methods of treatment and character of effluent to be obtained/ ^{were stated.} Accordingly, it then remained to be determined the exact location of the proposed mill in regards to the water course to which treated industrial wastes were to be discharged. The Hatboro location is on the water shed of Pennypack Creek, which supply is used for a public water supply. Due to this location, it is essential that the effluent from the industrial waste treatment plant be relatively clear,



free of toxic metals and salts, low suspended solids, no oil and having a pH near the neutral point. Following submission of the initial preliminary report and discussion of treatment methods, further design engineering work has taken place incorporating the procedures as tentatively outlined.

It is the purpose of this report and the accompanying engineering drawings to illustrate and describe the waste treatment facilities presently recommended and to serve as supplementary documents to your application for permit for construction and operation of these waste treatment facilities.

A survey of your wastes from the Philadelphia plant indicate generally the same characteristics as shown during the initial survey. Based on information obtained from you the flows from the new plant will be decreased from both the plating department and from the degreasing and tubbing operations. We have, however, recommended that facilities be installed based on your present flows with an allowable increase for plant expansion.

DESCRIPTION OF RECOMMENDED TREATMENT METHOD AND FACILITIES

Submitted herewith are engineering drawings showing the general layout of the treatment facilities and details of disposal on the treated waste, lagoons for sludge resulting from treatment, sanitary sewage and storm water. These drawings were prepared in cooperation between our office and Mr. Milo S. Holdstein, registered architect and engineer employed directly by the Penn Rivet and Machine Company. The functional features of the proposed system are the responsibilities of W. H. and L. D. Betz, while the mechanical and structural features were engineered by the client's engineers.

Flow measurements made at your plant indicate that under the present conditions of operation approximately 3500 gallons per day requires treatment. There are two sources of these contaminated wastes, namely; the mixed wastes from

the plating room and flow from degreasing and tubing operations. These wastes are piped separately from their source to the proposed treatment plant.

As indicated in our initial report, the plating done at the Philadelphia plant consists of copper, brass, nickel, aluminum and occasionally zinc; and these operations are to be similar at the new plant. The plating room wastes flow by gravity to a surge sump having a total capacity of approximately ^{1,446 gal to el = 3.0 X} 1,300 gallons. Two vertical non-clog pumps rated at 100 gpm, located in an adjacent dry well, are available to pump the wastes to one of four batch treatment tanks. Each treatment tank has a working capacity of 5,450 gallons and are equipped with motor agitators. The agitators are equipped with a sludge scraping blade for moving the precipitated sludge to the center outlet of the basin. Overflow ports from one basin to the other assure during operation that if the operator is not immediately available to valve control the tank inlet, the waste will flow on to the adjacent tank.

Suitable chemical feed tankages provided for preparing and/or measuring the materials to effect treatment. These feed tanks are piped to the points of application within the batch treatment tanks and discharge by gravity.

The treatment method as described in our preliminary report and confirmed by subsequent laboratory treatment consists of sulfuric acid for breaking ion complexes and chlorine for oxidizing the toxic salts. The chlorine being applied to the wastes in the form of ETH or Tarchloron first, assists in the clarification process of the waste. The actual treatment of a tank of wastes employs the addition of a pre-determined amount of chlorine based on the

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cyanide content and other chlorine demand materials in the wastes, using approximately 7 to 10 ppm of chlorine as Cl_2 for each ppm of cyanide present. Set pH adjustment by sulfuric acid to effect the greatest possible clarification of the wastes. During the addition of chlorine and sulfuric acid, the mechanical agitator is operating and chemical changes and coagulation are taking place in the waste. Following approximately 30 minutes mixing, the agitator is stopped and a quiescent period of approximately 12 hours is allowed.

The waste treated in our laboratory consisted of all discharge from the existing plating room. These wastes are of a mixed type and contain varied amounts of materials such as turbidity, oil, metals and miscellaneous drainages.

The actual operation of the plant will consist of making a rough determination for cyanide present and a pH reading on the batch of wastes to be treated. Sufficient chlorine, based on the above results will be added along with a measured amount of sulfuric acid for pH correction. In order to avoid the possible forming of HCN gas by over-acidification, a measured quantity of acid will be added to adjust the pH value of the wastes to a point within the desired range for treatment. The actual amount of acid to be added based on a pH value of the raw waste will be learned by experience only. Following this, the acid will be fed in very small increments until the proper pH value is reached for efficient and effective treatment.

Despite the fact that conventional treatments have indicated the optimum pH for satisfactory cyanide removal to be 8.5 or above, these particular wastes respond apparently to a much lower treatment in regards to the pH scale. As you are aware, three sets of wastes have been treated in our laboratory and

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the treatments, although similar, different optimum pH values were found. Tests on the treated samples indicate practically complete removal of the cyanide, the treated waste is clear, negligible amounts of oil and metal salts remaining. The concentration of inorganic salts in the treated effluent have been determined and average less than 300 ppm. pH value on the treated waste varies from neutral up to 3.5 on the different wastes tested. The reason for the rather wide variation in the range of pH is probably due to the very variable type of wastes resulting from the materials being processed. It is our considered opinion that upon installation of the new plant, utilizing more modern equipment and increased efficient operation, the wastes will be more uniform, thus allowing a definite treatment schedule to be established. Laboratory work on the existing wastes indicate that between 5 and 10 percent sludge is developed as a result of chemical precipitation.

As indicated on the prints, each treatment basin is equipped with a rotary decanting pipe, suitably designed for taking liquid off at any depth.

Laboratory experiments on the wastes have shown that there are times when oil separation takes place, the oil and/or scum being on the top of the treated sample. Each tank is equipped with an oil skimming device for removing this material and discharging it to the oil sump. One of the non-clog pumps mentioned previously takes suction in the sludge or oil sump for transferring this material to the lagoon.

Following removal of possible oil or scum, the supernatant is tested for cyanide, clarity and other desirables and if complete treatment has been effected, the waste is ready for discharge. The decanting pipe is suitably adjusted and the flow of treated liquid is started to the treated channel or final settling basin. As indicated on the print, a total capacity for 1580 gallons is available for final settling, inspection and controlled flow discharge.

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On the basis of 5,000 gallons of treated wastes per day, a retention period of 7 1/2 hours is possible at a 24 hour discharge, approximating 3.5 gpm to the storm sewer.

In order to avoid any cross connections between treated and untreated wastes, it will be necessary to clean the final settling basin by use of a portable pump or manual removal of precipitated sludge. We would not expect this operation to be necessary often owing to the long sedimentation period prior to discharge of the clear supernatant waste.

Following discharge of all the supernatant liquid under the direct supervision of the operator, the mechanical agitator is started and the sludge valve opened. The liquid sludge flows through the oil or waste channel to the sump from which the pump transfers it to the lagoon. Suitable lighting for the operators convenience in observing the liquid and sludge is provided.

As noted on the prints, two of the treatment tanks are out of doors while the other two are housed. To safeguard the operator against the remote possibility of ill effects resulting from HCN gas released, a high volume displacement power ventilator is installed. The ventilator will be started automatically when the building door is opened and will be manually cut off if no treatment is being done.

The waste from the degreasing and tubing operations enter the waste treatment plant through a separate gravity pipe line. These wastes are directed to one of two 1,000 gallon treatment tanks. Each tank has a capacity exceeding one days flow. The waste from degreasing and tubing operations are high in suspended solids, alkalinity and oil. In order to effect partial treatment, each of these tanks is equipped with a connection to the main acid

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feed tanks, an air grid in the bottom of the treatment tank for agitation and an oil skimming device. A full tank of waste is acid treated to the optimum point for oil separation and continuously operated with compressed air for mixing. Following the mixing and agitation period, the air is stopped and settling of the solids and separation of the oil takes place. The oil skimmer collects the separated oil and discharges it to the oil sump and hence pumped to the lagoon. Following oil removal, the tank is drained of both solids and liquid by the pump. The pump in turn discharges the mixture to the header leading to the batch treatment tanks. This liquid is subsequently treated along with the plating mill wastes without regard to any regularly scheduled discharge.

As shown on the print, a part of the waste treatment system includes the construction of four lagoons. Each lagoon has a sludge volume capacity of ^{55,000} 38,600 gallons. For calculation purposes, based on 5,000 gallons of waste treated per day, yielding a sludge volume of 10%, each lagoon has a capacity for three months operation. With four lagoons being constructed, a total of one year's sludge capacity is available. The above calculation and capacity is without regard for normal ground seepage, evaporation and return of clarified supernatant liquid resulting from extended settling periods. Each lagoon is equipped with a supernatant decanter for withdrawing clarified liquid back to the treatment plant.

It is suggested that one lagoon be used exclusively for the oil skimmings. By this method of operation, when the oil has accumulated to a considerable depth it can be withdrawn from the surface and disposed of by burning or other convenient method.

It is our recommendation that the other lagoons be used separately,



to allow for drying, seepage and evaporation to take place on the remaining two during that period. Staggered operation as suggested will allow long use of the lagoons without cleaning.

No outlets to any stream or river are provided from the lagoons.

With the extremely critical location where the proposed plant is to be erected, we believe that the plant as designed is the most flexible type for effecting complete treatment of the wastes and producing an effluent that will be satisfactory to the Pennsylvania Department of Health authorities. As indicated, all studies have been made on wastes emanating from the Philadelphia plant with the assumption that similar wastes are to be discharged from the proposed plant. In case these wastes vary, a batch treatment type plant is sufficiently flexible so that practically any type of treatment can be successfully effected. We can foresee the possibility of minor changes in dosages of the prescribed chemicals or even an additional chemical being required when the plant is put in operation. These factors have all been considered in the design and layout of these treatment works.

Testing and control will be required of each batch treated prior to its discharge. Suitable laboratory equipment and reagents will be ^s necessary part of the final layout.

The successful operation of this plant will depend upon the type of operating personnel assigned. We suggest that you give consideration to authorizing our services during the initial start-up and treatment in order that we may properly adjust the treatment and thoroughly instruct your operators in methods of treatment and control. Assurance of authorization for our start-up services should be given to the State Department so they can be guaranteed no untreated waters will be discharged.

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Copies of this report with appended drawings and application etc., are to be submitted to the Pennsylvania Department of Health, district office, Philadelphia. Should any discussions or questions arise during their review of this report, we will be pleased to attempt clarification by correspondence or by conference as may be required.

It has been a pleasure to serve you and we assure you of our continued cooperation and interest throughout the construction of this plant and its ultimate operation.

Respectfully submitted,

W. H. and L. D. BETZ

Max U. Priester
D. S. H.

Max U. Priester
Assistant Director
Consulting Division

MUP/TH

John E. Gorman



PASTE ANALYSES

15 Minutes Composites

Samples collected from plating mill - week 12/15 and 1/12/48

<u>SAMPLES MARKED -</u>	12/15	12/26	12/27	12/18	12/19	1/12/48
Analysis Number	A-177	178	179	183	184	
Oil, ppm	32	24	30	12	20	10
Phenolphthalein Alk. as CaCO ₃ , ppm	1100	2200	2099	1330	2240	1390
Methyl Orange Alk. as CaCO ₃ , ppm	1710	3050	2800	1920	2360	1856
pH Electric	11.54	12.54	12.32	12.07	12.33	12.5
Color	160	550	350	125	3500	
Settleable Solids cc/L	15.0	10.0	13.0	4.0	78.0	
Suspended Solids, ppm	156	164	166	126	147	
Cyanide - HCN, ppm	173	198	178	194	112	134
B.O.D., ppm		6.5	0			

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PASTE ANALYSIS

15 Minutes Composites

Samples collected from deprocessing and rolling operations - week 12/15

<u>SAMPLE TAKEN</u>	<u>12/15</u>	<u>12/16</u>	<u>12/17</u>	<u>12/18</u>	<u>12/19</u>
Analysis number	157	158	159	160	161
Oil, ppm	400	280	210	206	530
Phenolanthracene					
Alk. as CaCO_3 , ppm	22500	21000	21000	21000	22100
Methyl Orange					
Alk. as CaCO_3 , ppm	13700	20100	20000	20200	26800
pH Electrode	13.11	13.10	13.15	13.20	13.22
Color	500	1800	600	500	1200
Settleable Solids cc/L	1.4	45.0	32.0	25.0	45.0
Suspended Solids, ppm	592	1120	1276	1500	2182
B.O.D. ppm		22.5	0		

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TREATED WASTE ANALYSIS

Average of laboratory results

Oil (ether extracted), ppm	0.5 to 2.0
Phenolphthalein Alkalinity as CaCO_3 , ppm	0 - 5
Methyl Orange Alkalinity as CaCO_3 , ppm	70 - 150
pH	7.0 - 8.3
Color	15 - 40
Settleable Solids cc/L	0
Suspended Solids, ppm	5 - 20
Chlorides, ppm	200 - 300
B.O.D., ppm	5 - 10
Cyanide as CN , ppm	0 - 0.2

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